

Statement of

LANCE J. HOFFMAN

Professor, The George Washington University

before the

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My name is Lance J. Hoffman. I am a professor in the Department of Electrical Engineering and Computer Science at The George Washington University in Washington, D. C. I also am Director of the School of Engineering's Cyberspace Policy Institute and the author or editor of five books and numerous articles on computer security and privacy. My most recent book is a compendium of papers on the encryption policy problem entitled *Building in Big Brother* (Springer-Verlag, New York, 1995).

Currently, I am the principal investigator for a project entitled "Cryptography Products and Market Survey". As part of that project, we have recently produced a report entitled "Growing Development of Foreign Encryption Products in the Face of U. S. Export Regulations". I am leaving you copies of that report, which is also available from the Institute or on our Web site at <http://www.seas.gwu.edu/seas/institutes/cpi/library/papers.html>, where detailed tables and charts supporting this testimony are also available. We did this work in cooperation with NAI Labs, the Security Research Division of Network Associates, Inc., Glenwood, Md. The project manager for NAI Labs, Mr. David Balenson, is with me today. We were assisted in this project by three students.

In the project, we surveyed encryption products developed outside the United States and found that the **development of cryptographic products outside the United States is not only continuing but is expanding to additional countries; with rapid growth of the Internet, communications-related cryptography especially is experiencing high growth.**

As of June 8, 1999, we **identified 805 hardware and/or software products incorporating cryptography manufactured in 35 countries outside the United States.** As

shown in Attachment 1, the greatest number of foreign cryptographic products are manufactured in the United Kingdom, followed by Germany, Canada, Australia, Switzerland, Sweden, the Netherlands, and Israel in that order. Other countries accounted for slightly more than a quarter of the world's total of encryption products.

**These 805 foreign cryptographic products represent a 149-product increase (22%) over the most recent previous survey in December 1997. At least 167 of them use strong encryption,** the kind that one cannot export from the United States without applying for and receiving export license approval. The algorithms used in these are Triple DES, IDEA, BLOWFISH, CAST-128, or RC5.

**Cryptography product manufacturers have appeared in six new countries since December 1997:** Estonia, Iceland, Isle of Man, Romania, South Korea, and Turkey. **There has also been a large increase in the number of products produced by** certain countries. The **United Kingdom** jumped by 20 products from 119 to 139, and **Germany** jumped from 76 products to 104. Also notable was **Japan's** increase, from six products to 18, and **Mexico's**, from a single product to six.

**There are now 512 foreign companies that either manufacture or distribute foreign cryptographic products in 70 countries outside the United States.** Attachment 2 lists these countries.

**On average, the quality of foreign and U. S. products is comparable.** We have encountered poor products both within and outside the U.S., and we have encountered good products both within and outside the U.S. There are a number of very good foreign encryption products that are quite competitive in strength, standards compliance, and functionality.

**A significant number of foreign competitors to U.S. manufacturers of software and hardware with encryption capabilities are developing products with strong encryption, and have as customers a number of large foreign or multinational corporations.** The report gives thumbnail sketches of some of these companies and their offerings.

**We found some examples of advertising used by non-U. S. companies that generally attempted to create the perception that purchasing American products may involve significant red tape and the encryption may not be strong due to export controls.** As an example, we show in Attachment 3 material from Cybernetica's Web site in Estonia. We give several other examples of similar advertising in the report.

**Companies want to sell encryption products that meet certain accepted worldwide standards.** Encryption experts from all over the world have contributed to two important international standards efforts, IPsec and the Advanced Encryption Standard. In the case of IPsec, there are currently implementations (complete or in the works) from at least nine companies in five foreign countries. One effort, the KAME Project, is a joint effort of several Japanese companies (Fujitsu, Hitachi, IJ Research Laboratory, NEC, Toshiba, and Yokogawa).

In 1997, the National Institute of Standards and Technology (NIST) solicited algorithms for the Advanced Encryption Standard (AES) to replace the Data Encryption Standard (DES) as a U. S. government encryption standard. Individuals and companies from eleven different foreign countries proposed 10 out of the 15 candidate algorithms submitted to NIST. So it is very possible that the next U.S. government encryption standard will have been designed outside the United States. Details on who submitted what algorithm are given in Attachment 4.

**Finally, our empirical product data could be combined with economic measures and**

economic theories to better explain why we are seeing the observed growth in the cryptography marketplace, and to examine the effects of Internet growth, e-commerce development, and regulatory actions on the international cryptographic market over time, thus getting better insights into the implications of various policy options. We should be able to combine previous work with studies already available on the information technology sector and the data in our study to better understand the changes we are seeing in the global marketplace, and thus be able to more easily adjust national laws for a global economy

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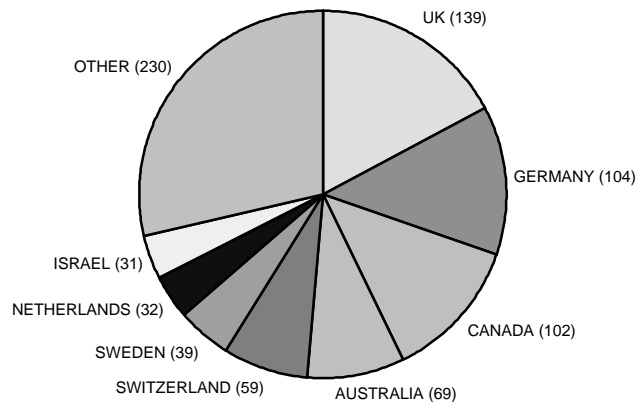
## Attachment 1. Foreign Cryptographic Products by Country

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### **Foreign Cryptographic Survey Results (as of May 1999)**

The updated survey identified a total of 805 foreign cryptographic products from 35 countries:

Argentina	Australia	Austria
Belgium	Canada	Czech Republic
Denmark	Estonia	Finland
France	Germany	Greece
Hong Kong	Iceland	India
Iran	Ireland	Isle Of Man
Israel	Italy	Japan
Mexico	Netherlands	New Zealand
Norway	Poland	Romania
Russia	South Africa	South Korea
Spain	Sweden	Switzerland
Turkey	UK	



At least 167 of these foreign cryptographic products implement "strong" cryptographic algorithms, including Triple DES, IDEA, BLOWFISH, RC5, or CAST.

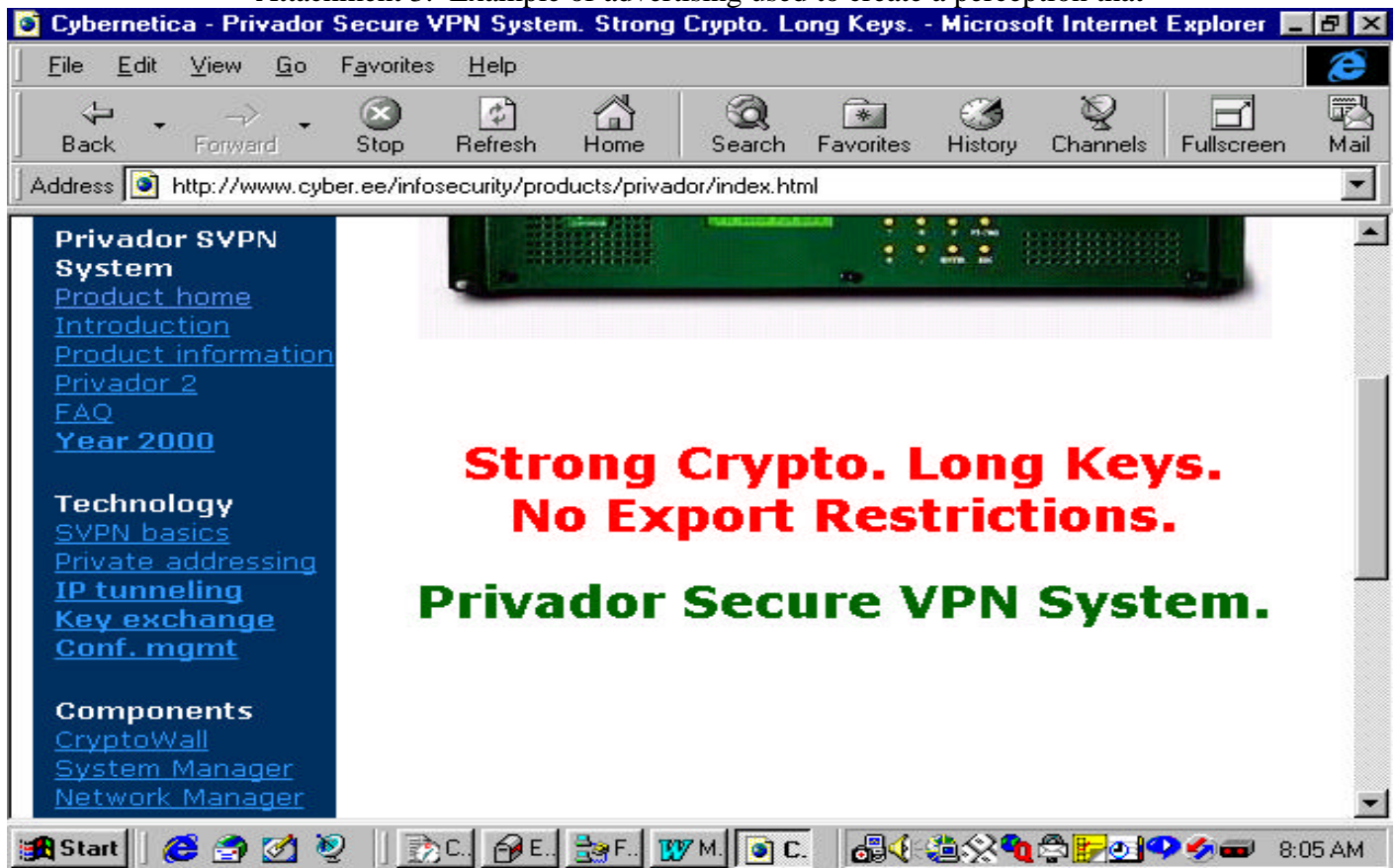
We identified 512 foreign cryptography companies (including distributors as well as manufacturers) in 70 countries.

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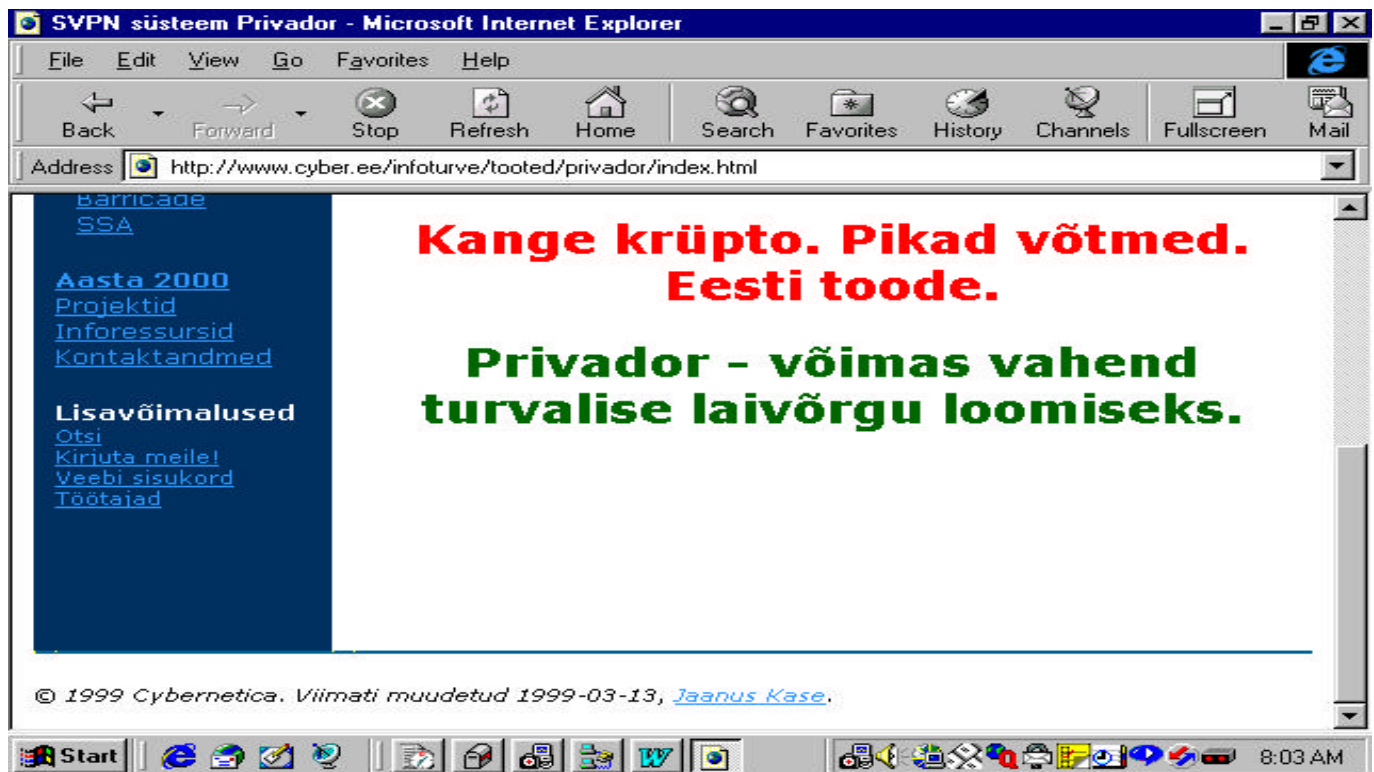
Attachment 2. Foreign countries in which cryptography is manufactured or distributed

Argentina	Malaysia
Australia	Malta
Austria	Mauritius
Bahrain	Mexico
Baltic Republics	Nepal
Bangladesh	Netherlands
Belgium	New Zealand
Brazil	Nigeria
Brunei	Norway
Canada	Oman
Chile	Philippines
Colombia	Poland
Cyprus	Portugal
Czech Republic	Qatar
Denmark	Reunion
Estonia	Romania
Finland	Russia
France	Saudi Arabia
Germany	Singapore
Ghana	Slovak Republic
Greece	South Africa
Hong Kong	South Korea
Iceland	Spain
India	Sweden
Indonesia	Switzerland
Iran	Taiwan
Ireland	Thailand
Isle of Man	Turkey
Israel	United Arab Emirates
Italy	United Kingdom
Ivory Coast	Venezuela
Japan	West Indies
Kenya	Yugoslavia
Kuwait	Zimbabwe
Luxembourg	
Madagascar	

Attachment 3. Example of advertising used to create a perception that



American products = red tape and weak encryption



Attachment 4. Proposed Candidates for Advanced Encryption Standard

Country	Candidate Algorithm	Submittor(s)
Australia	LOKI97	Lawrie Brown, Josef Pieprzyk, Jennifer Seberry
Belgium	RIJNDAEL	Joan Daemen, Vincent Rijmen
Canada	CAST-256	Entrust Technologies, Inc.
	DEAL	Outerbridge, Knudsen
Costa Rica	FROG	TecApro Internacional S.A.
France	DFC	Centre National pour la Recherche Scientifique (CNRS)
German	MAGENTA	Deutsche Telekom AG
Japan	E2	Nippon Telegraph and Telephone Corporation (NTT)
Korea	CRYPTON	Future Systems, Inc.
USA	HPC	Rich Schroepel
	MARS	IBM
	RC6	RSA Laboratories
	SAFER+	Cylink Corporation
	TWOFISH	Bruce Schneier, John Kelsey, Doug Whiting, David Wagner, Chris Hall, Niels Ferguson
UK/Israel/Norway	SERPENT	Ross Anderson, Eli Biham, Lars Knudsen

Smid, M., and M. Dworkin, Special Report on the First AES Conference, presented at Crypto '98 Conference, August 1998, <http://csrc.nist.gov/encryption/aes/round1/crypto98.pdf>.